TUTORIAL 3

Name:
Instructor:

1. A sample of chlorine gas occupies a volume of 946 mL at a pressure of 726 mmHg. Calculate the pressure of the gas (in mmHg) if the volume is reduced at constant temperature to 154 mL.

2. What is the molar mass of a gas if a 3.16 g sample of gas at 0.750 atm and 45°C occupies a volume of 2.05 L? *(Given: R = 0.0821 atm.L/mol.K).*

3. X-ray crystal studies show that an unknown metal has a face centered cubic structure. The edge length of the unit cell is 407 pm.

   a) What is the radius of the metal atom?

   b) The density of the metal is 10.5 gcm^{-3}. What is the atomic mass of the metal?

4. Polonium crystallizes in a simple cubic lattice. What is the distance between nearest neighbor atoms if the first order diffraction of x-rays of λ = 1.785 Å from the parallel faces of its unit cell occurs with an angle of 2θ = 31.0°.

   (Given: 1 Å = 10^{-10} m)

5. How much heat, does it take to raise the temperature of 222 g of water from 15.0°C to 90.0°C. *(Given: Specific heat of water is 4.184 J g^{-1} K^{-1})*

6. A quantity of 1.553 g of methanol (CH_3OH) was burned in a constant-volume bomb calorimeter. Consequently the temperature of water rose by 6.50°C. If the quantity of water surrounding the calorimeter was exactly 1131 g and the heat capacity of calorimeter was 2.02 kJ/K, calculate the molar heat of combustion of CH_3OH.

7. Ethylene derived from petroleum, is used to make ethanol for use as fuel or solvent, the reaction is

   C_2H_4 (g) + H_2O (l) $\rightarrow$ CH_3CH_2OH (l)

   Calculate $\Delta H°$ for this reaction, when the standard enthalpies of formation C_2H_4 (g) = 52.26 kJ/mol., H_2O (l) = -285.8 kJ/mol, CH_3CH_2OH (l) = -277.7 kJ/mol

8. Use the following equation:

   H_2S (g) + 3/2 O_2 (g) $\rightarrow$ H_2O (l) + SO_2 (g) ΔH = -562 kJ
   CS_2 (l) + 3 O_2 (g) $\rightarrow$ CO_2 (g) + 2 SO_2 (g) ΔH = -1075 kJ

   Calculate the enthalpy change for the reaction

   CS_2 (l) + 2 H_2O (l) $\rightarrow$ CO_2 (g) + 2 H_2S (g) ΔH = ?